Quick SAS Cabling Guide

A Dell Technical White Paper

PowerVault™ MD3200 and MD3200i Storage Arrays

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Components of Dell PowerVault™ MD32xx/MD32xxi System

The following are the integral blocks of the Dell PowerVault™ MD32xx/MD32xxi storage array systems:

1. **MD3200** is the SAS **RAID array** residing in the enclosure with 12 horizontally positioned 3.5" disk slots
2. **MD3220** is the SAS **RAID array** residing in the enclosure with 24 vertically positioned 2.5" disk slots
3. **MD3200i** is the iSCSI **RAID array** residing in the enclosure with 12 horizontally positioned 3.5" disk slots
4. **MD3220i** is the iSCSI **RAID array** residing in the enclosure with 24 vertically positioned 2.5" disk slots
5. **MD1200** is the RAID array **expansion** residing in the enclosure with 12 horizontally positioned 3.5" disk slots
6. **MD1220** is the RAID array **expansion** residing in the enclosure with 24 vertically positioned 2.5" disk slots

MD3200 and MD3220 **back view**:

> **NOTE:**
>
> Only a single SAS or iSCSI RAID array must be present in the system.

MD3200i and MD3220i **back view**:

MD1200 and MD1220 **back view**:

> **NOTE:**
>
> This guide makes an assumption that the user has MD32xx/MD32xxi system operating in the duplex mode (the recommended mode of operation), i.e. when both RAID controllers are present and are fully operational.

Front view of MD3200/MD3200i/MD1200 (top) and MD3220/MD3220i/MD1220 (bottom):

MD32xx SAS RAID array has SAS RAID controllers (RCs):
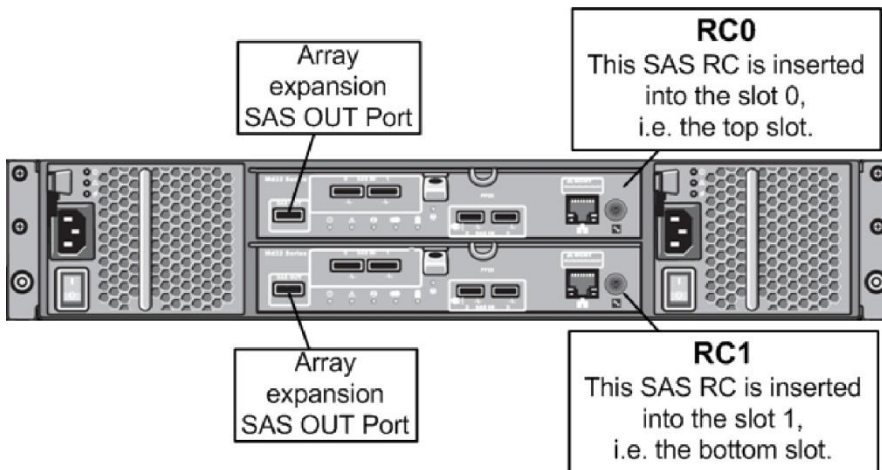
MD32xxi iSCSI RAID array has iSCSI RAID controllers (RCs):

Array expansion enclosure has enclosure management modules (EMMs):

Supported System Configurations

The MD32xx/MD32xxi storage array system may consist of the following twenty four order independent combinations of the enclosures with 12 horizontally positioned 3.5" disk slots and the enclosures with 24 vertically positioned 2.5" disk slots.

Table 1. Supported System Configurations

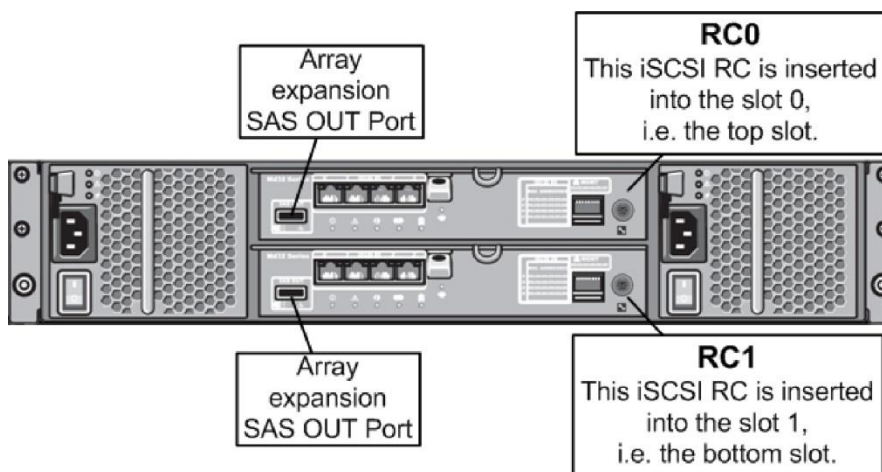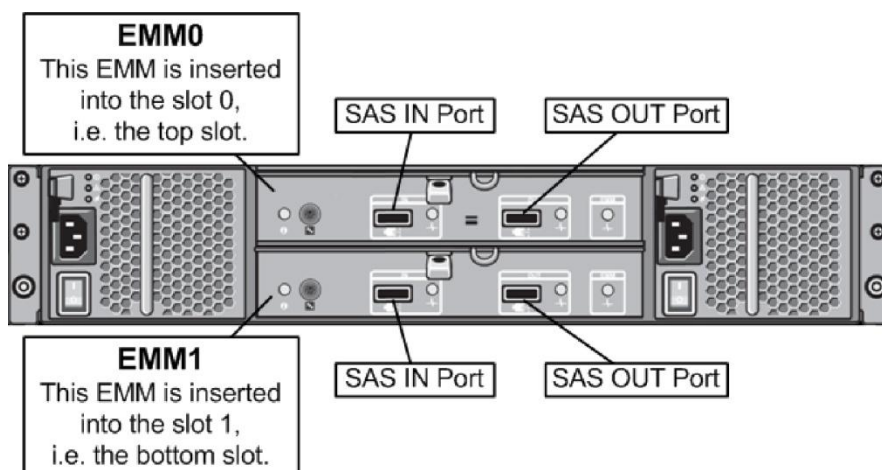| Config. ID	Total Number of Enclosures	Maximum Number of Disks	Number of Enclosures with 12 Disk Slots	Number of Enclosures with 24 Disk Slots	Simple Cascade Scheme Illustration	Fault-tolerant Asymmetric Cabling Scheme Illustration
C01	8	96	8	0	(hyperlink) Figure 1	(hyperlink) Figure 9
C02	7	96	6	1	(hyperlink) Figure 2	(hyperlink) Figure 10
C03	7	84	7	0	(hyperlink) Figure 2	(hyperlink) Figure 10
C04	6	96	4	2	(hyperlink) Figure 3	(hyperlink) Figure 11
C05	6	84	5	1	(hyperlink) Figure 3	(hyperlink) Figure 11
C06	6	72	6	0	(hyperlink) Figure 3	(hyperlink) Figure 11
C07	5	96	2	3	(hyperlink) Figure 4	(hyperlink) Figure 12
C08	5	84	3	2	(hyperlink) Figure 4	(hyperlink) Figure 12
C09	5	72	4	1	(hyperlink) Figure 4	(hyperlink) Figure 12
C10	5	60	5	0	(hyperlink) Figure 4	(hyperlink) Figure 12
C11	4	96	0	4	(hyperlink) Figure 5	(hyperlink) Figure 13
C12	4	84	1	3	(hyperlink) Figure 5	(hyperlink) Figure 13
C13	4	72	2	2	(hyperlink) Figure 5	(hyperlink) Figure 13
C14	4	60	3	1	(hyperlink) Figure 5	(hyperlink) Figure 13
C15	4	48	4	0	(hyperlink) Figure 5	(hyperlink) Figure 13
C16	3	72	0	3	(hyperlink) Figure 6	(hyperlink) Figure 14
C17	3	60	1	2	(hyperlink) Figure 6	(hyperlink) Figure 14
C18	3	48	2	1	(hyperlink) Figure 6	(hyperlink) Figure 14
C19	3	36	3	0	(hyperlink) Figure 6	(hyperlink) Figure 14
C20	2	48	0	2	(hyperlink) Figure 7	(hyperlink) Figure 7
C21	2	36	1	1	(hyperlink) Figure 7	(hyperlink) Figure 7
C22	2	24	2	0	(hyperlink) Figure 7	(hyperlink) Figure 7
C23	1	24	0	1	(hyperlink) Figure 8	(hyperlink) Figure 8
C24	1	12	1	0	(hyperlink) Figure 8	(hyperlink) Figure 8

Fault-tolerant Asymmetric Cabling Scheme

Although more complex to set up, the fault-tolerant asymmetric cabling scheme is the recommend way of connecting the expansion enclosures to the RAID array as it makes the enclosure loss protection possible.

Enclosure loss protection is an attribute of a disk group. Enclosure loss protection guarantees accessibility to the data on the virtual disks in a disk group if a total loss of communication occurs with a single expansion enclosure. An example of total loss of communication might be loss of power to the expansion enclosure or failure of both EMM modules. Naturally, the enclosure loss protection is not guaranteed if a physical disk has already failed in the disk group. In this situation, losing access to an expansion enclosure and consequently another physical disk in the disk group causes a double physical disk failure and loss of data.

Enclosure loss protection is achieved when you create a disk group where all of the physical disks that comprise the disk group are located in different expansion enclosures. This distinction depends on the RAID level.

For the diagram illustrating how to cable the specific configuration you have please see ^(hyperlink) Table 1

Note: An incorrect SAS cabling will be detected by the array system. The MD32xx/MD32xxi Storage Manager will warn you about the mis-wired enclosures by logging a major event in the event log. In addition, the Recovery Guru will point you to the mis-wire condition and provide you some guidance on correcting the problem. Please remember that a mis-wire condition will only be reported if incorrectly plugged SAS cables result in a non-working configuration. In theory, it is possible to attach the expansion enclosures in a technically correct manner, which will not be optimal but still be functional. The mis-wire events will not be logged for a configuration of this type.

Simple Cascade Cabling Scheme

The simple cascade cabling scheme could be used when the enclosure loss protection is not required. The advantage of using this scheme is the simplicity of the initial system set up.

For the diagram illustrating how to cable the specific configuration you have please see ^(hyperlink) Table 1

Diagrams

This section contains diagrams illustrating the MD32x/MD32xxi system configurations.

The last diagram ^(hyperlink) Figure 15 contained in this section is a special case: it contains picture of the labels which you can print, cut out and attach to the both ends of every SAS cable used in your configuration for an easy identification. If after initial wiring your array system has to be transported/moved then the labeled SAS cables will simplify the task of re-assembling the system.

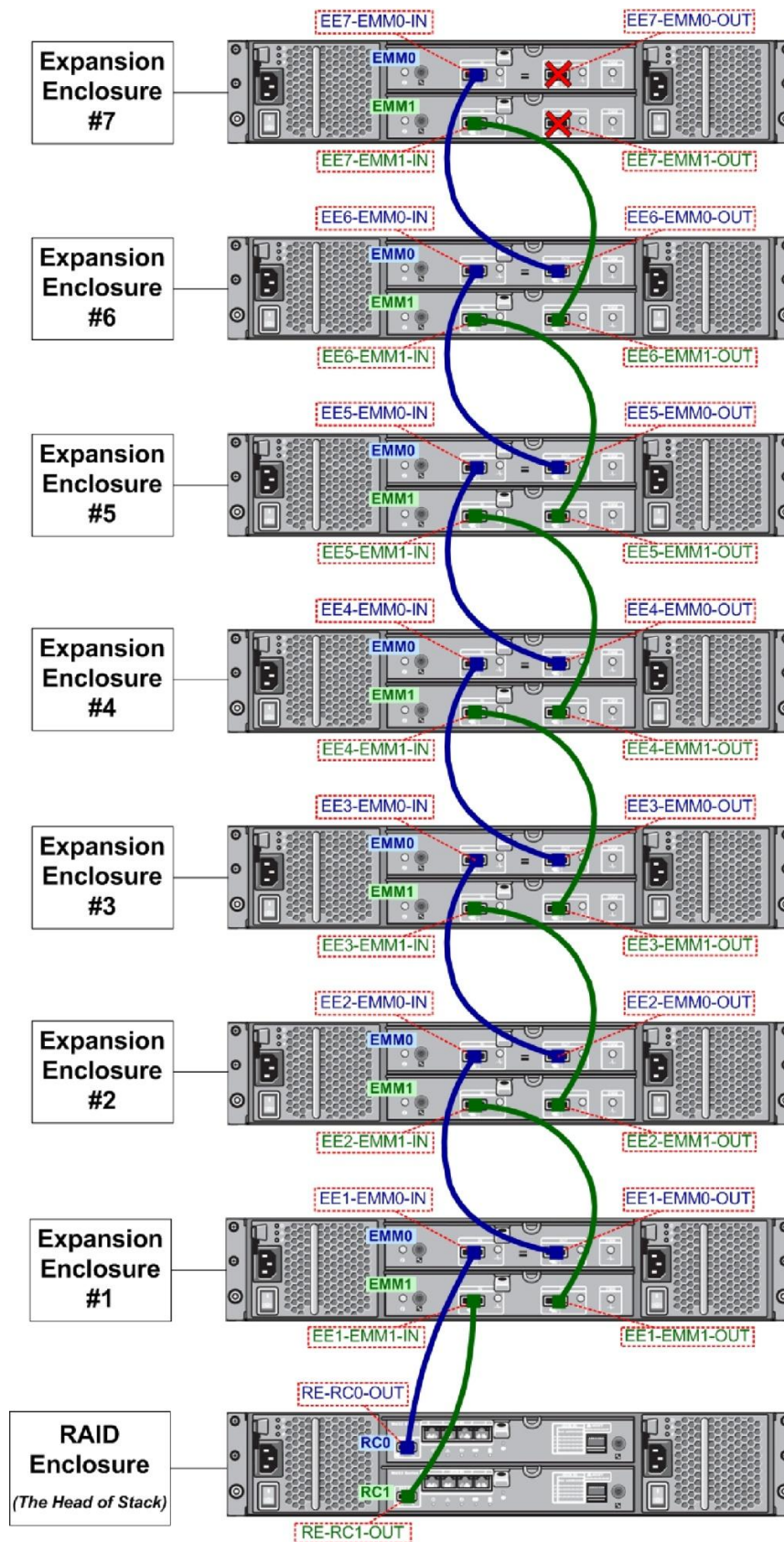**Figure 1.   Simple Cascade Cabling Scheme: Configuration C01**

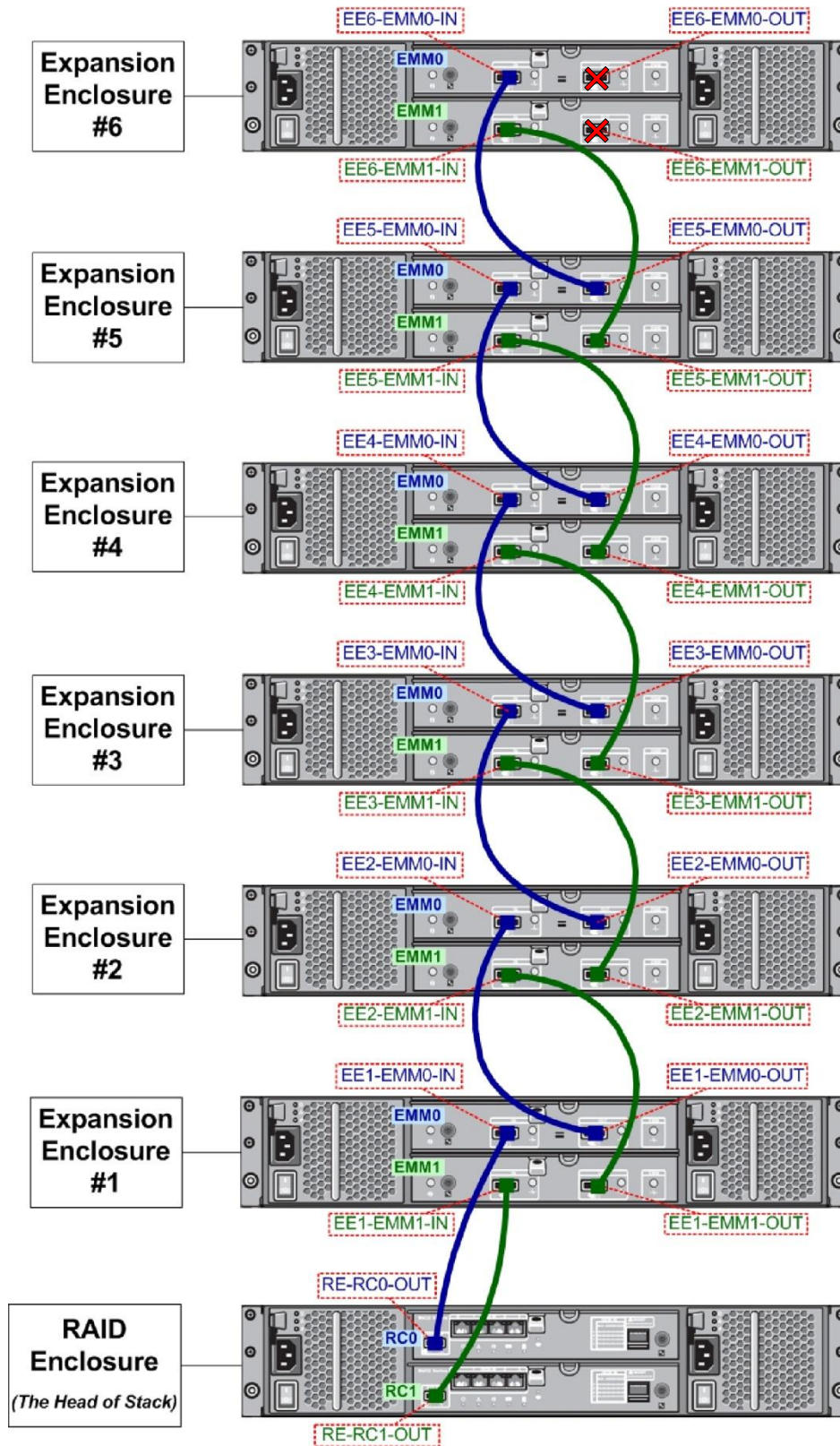**Figure 2.   Simple Cascade Cabling Scheme: Configurations C02, C03**

Figure 3. Simple Cascade Cabling Scheme: Configurations C04, C05, C06
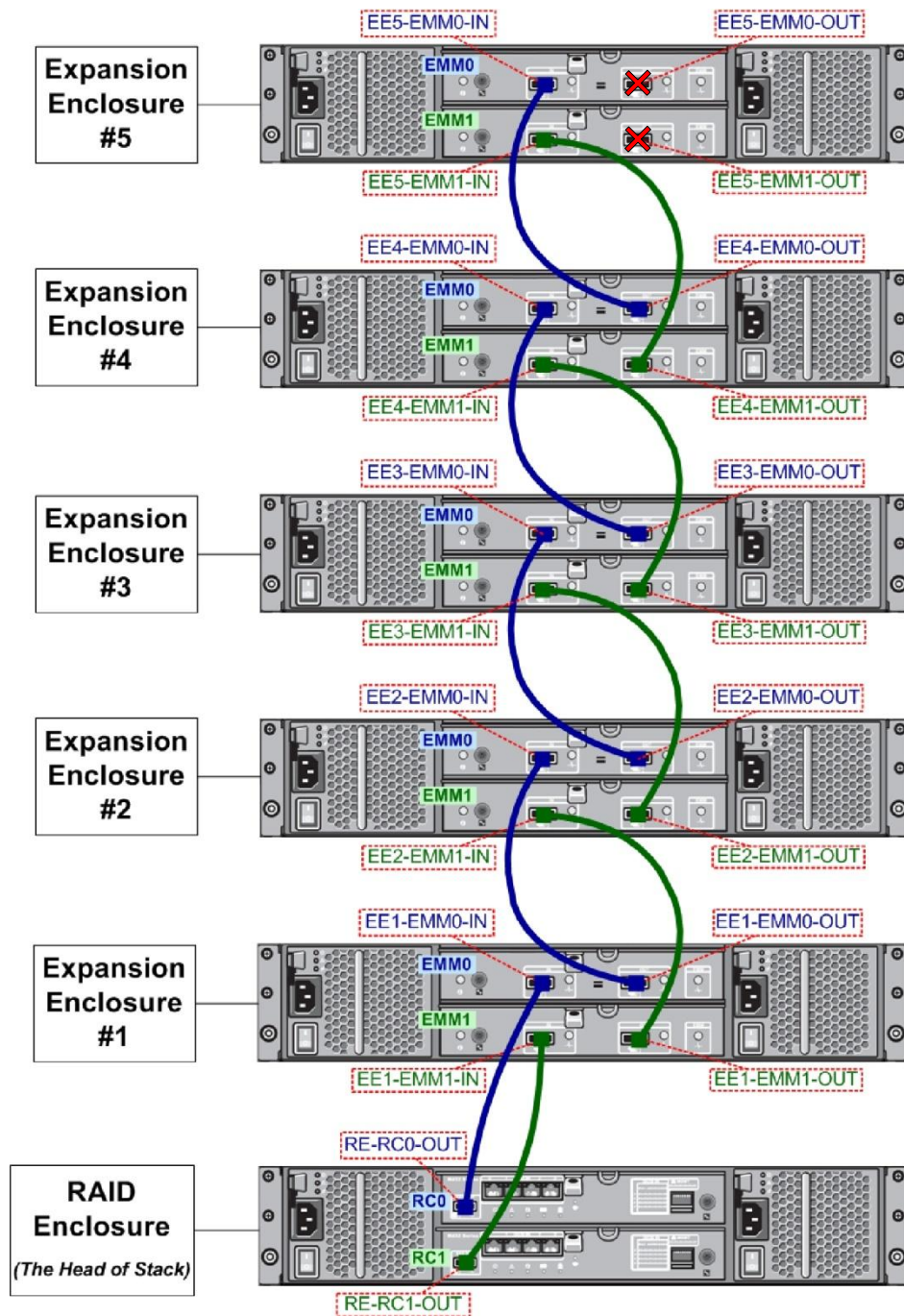
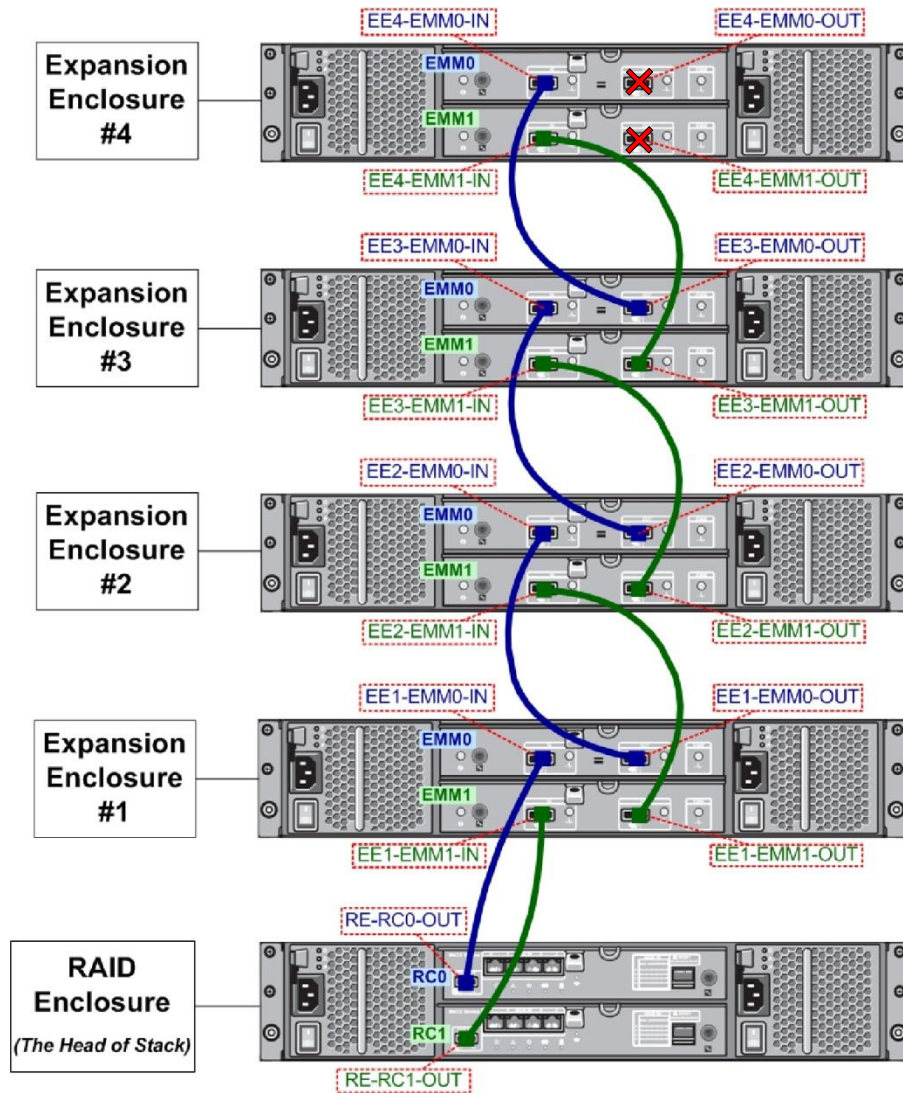**Figure 4.   Simple Cascade Cabling Scheme: Configurations C07, C08, C09, C10**

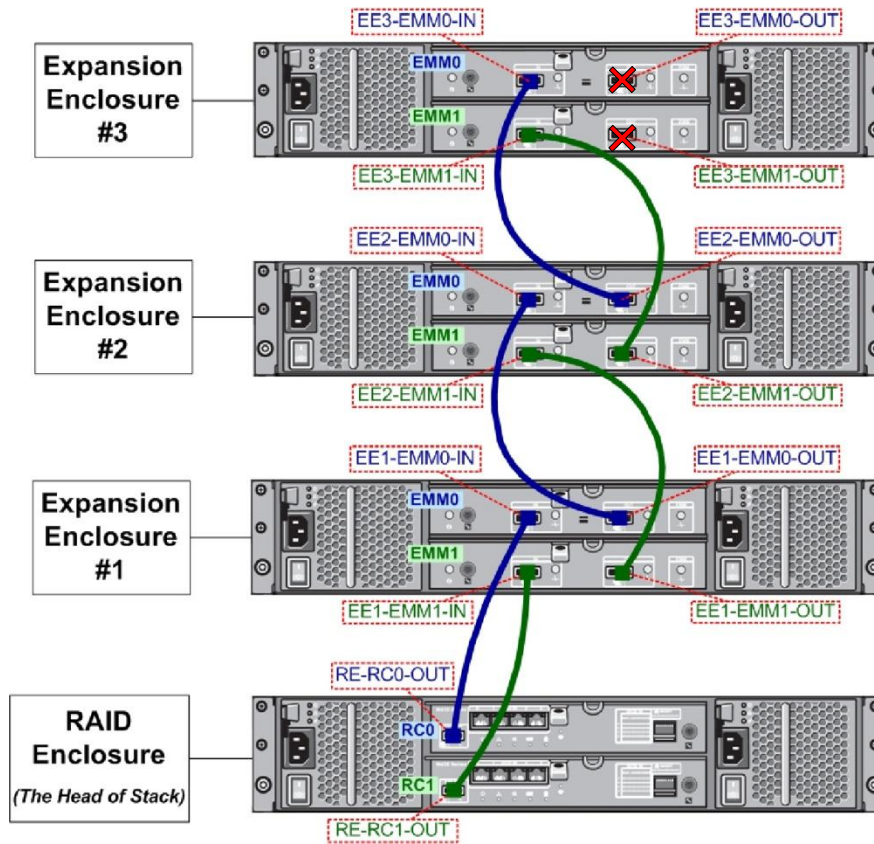**Figure 5.   Simple Cascade Cabling Scheme: Configurations C11, C12, C13, C14, C15**

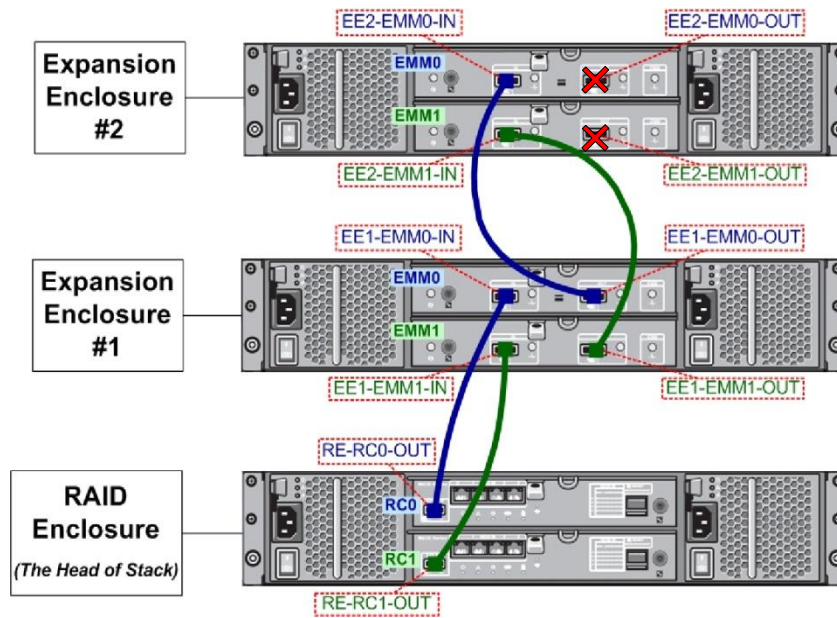**Figure 6.** Simple Cascade Cabling Scheme: Configurations C16, C17, C18, C19

Figure 7. Two Enclosures: Configurations C20, C21, C22
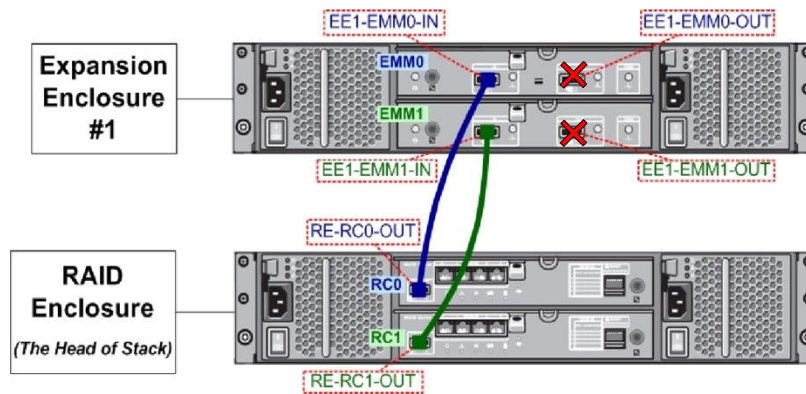
Figure 8.   Single Enclosure: Configurations C23, C24
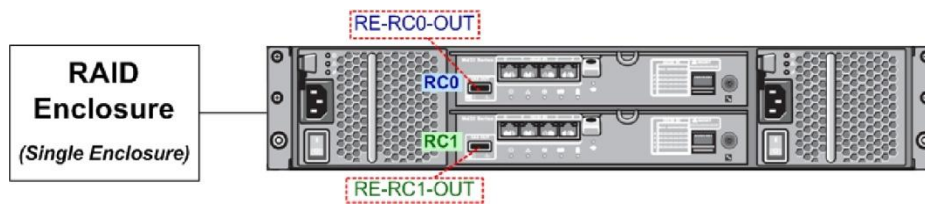
Figure 9.   Fault-tolerant Asymmetric Cabling Scheme: Configurations C01
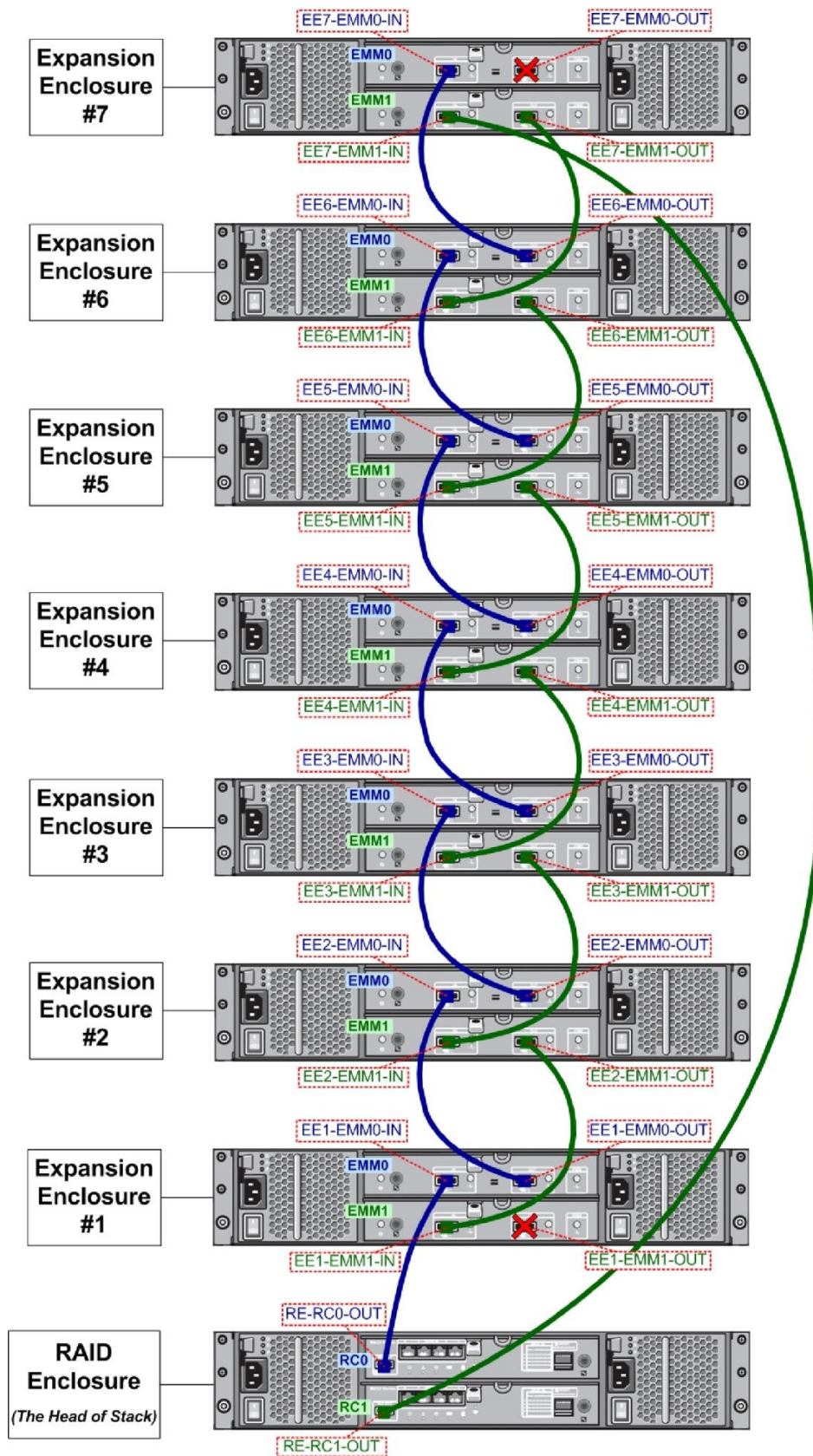
Figure 10. Fault-tolerant Asymmetric Cabling Scheme: Configurations C02, C03
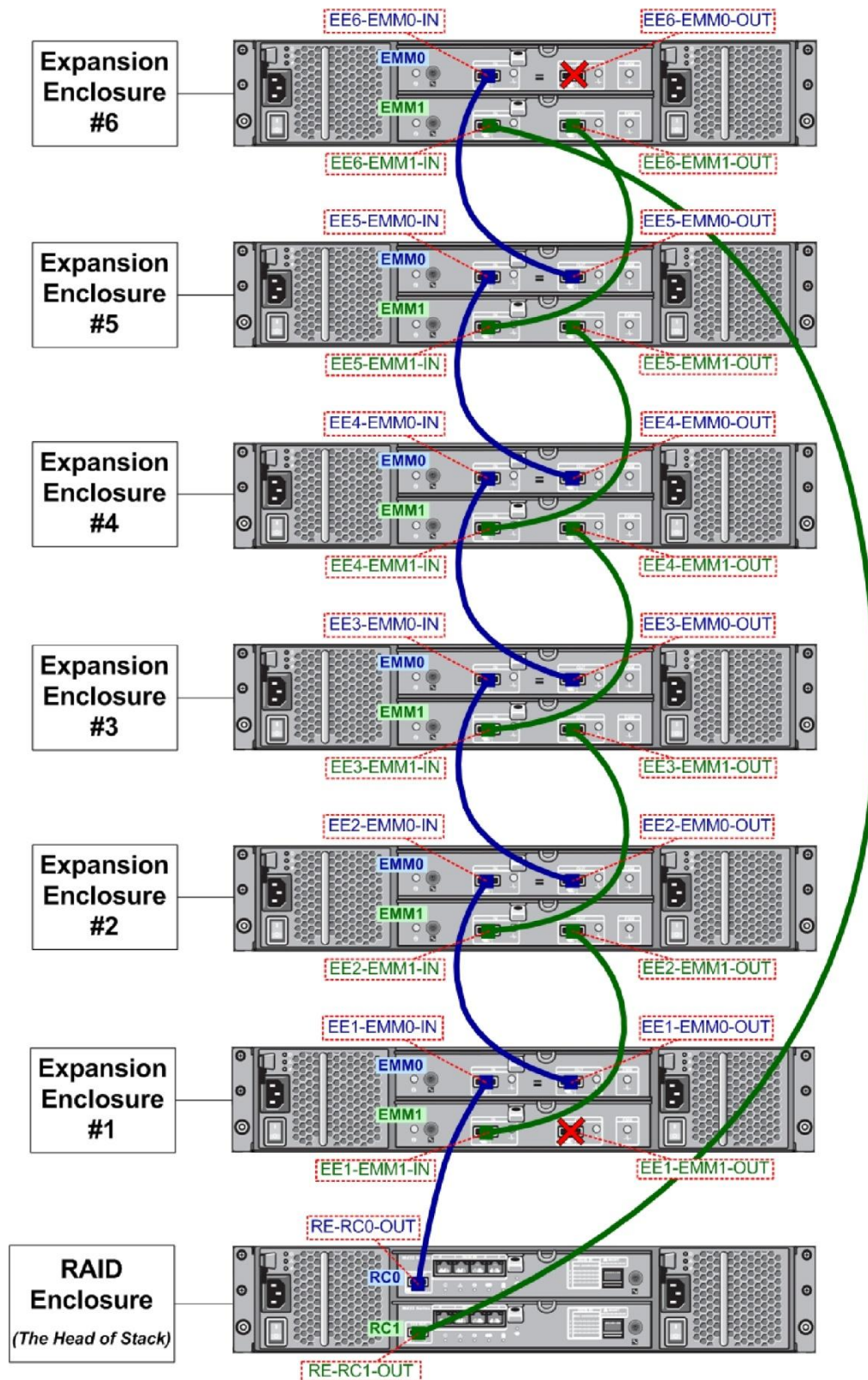
Figure 11. Fault-tolerant Asymmetric Cabling Scheme: Configurations C04, C05, C06
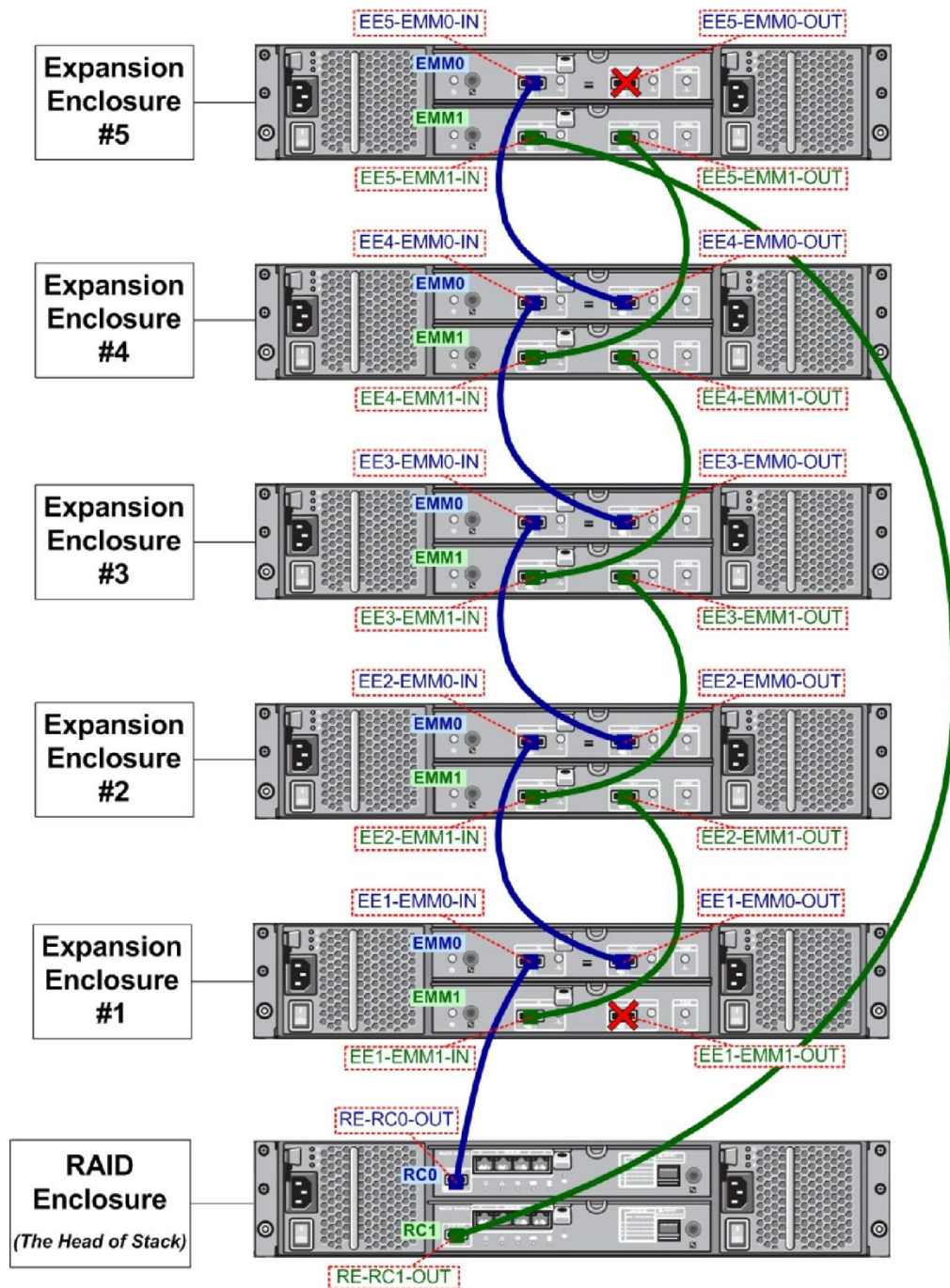
Figure 12.   Fault-tolerant Asymmetric Cabling Scheme: Configurations C07, C08, C09, C10
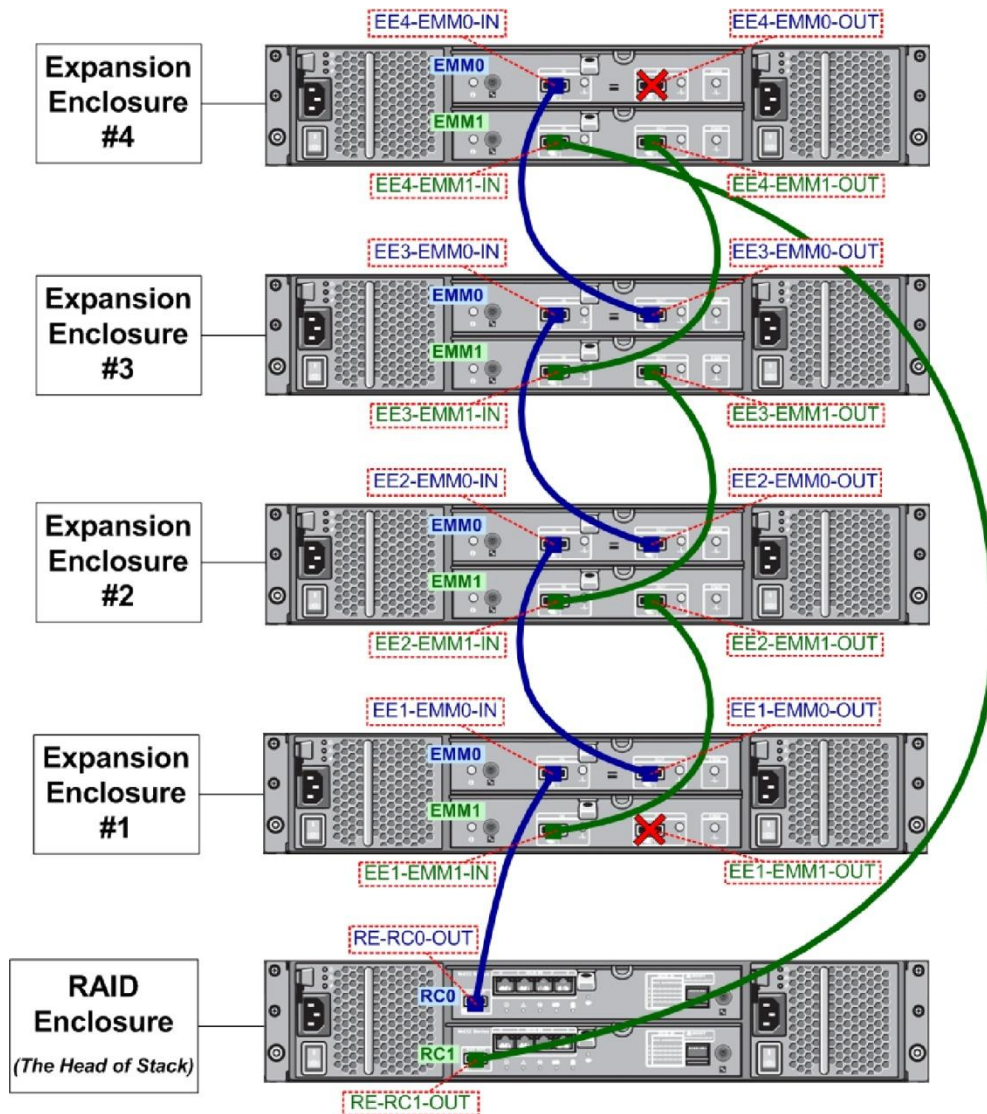
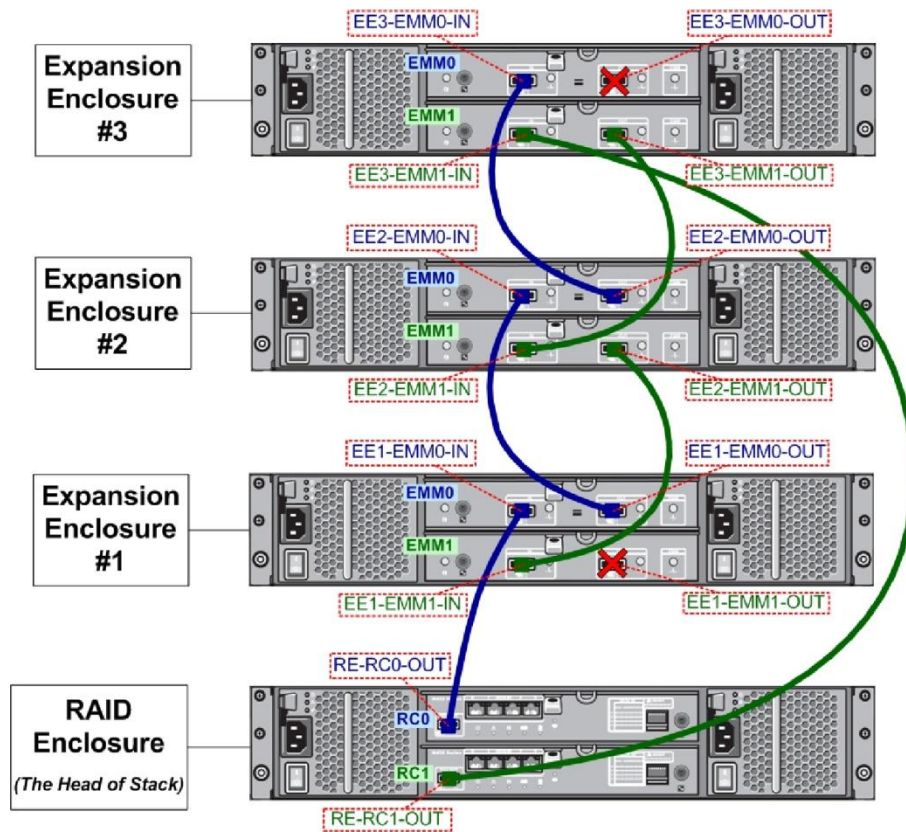**Figure 13.   Fault-tolerant Asymmetric Cabling Scheme: Configurations C11,C12,C13,C14,C15**

Figure 14.   Fault-tolerant Asymmetric Cabling Scheme: Configurations C16, C17, C18, C19
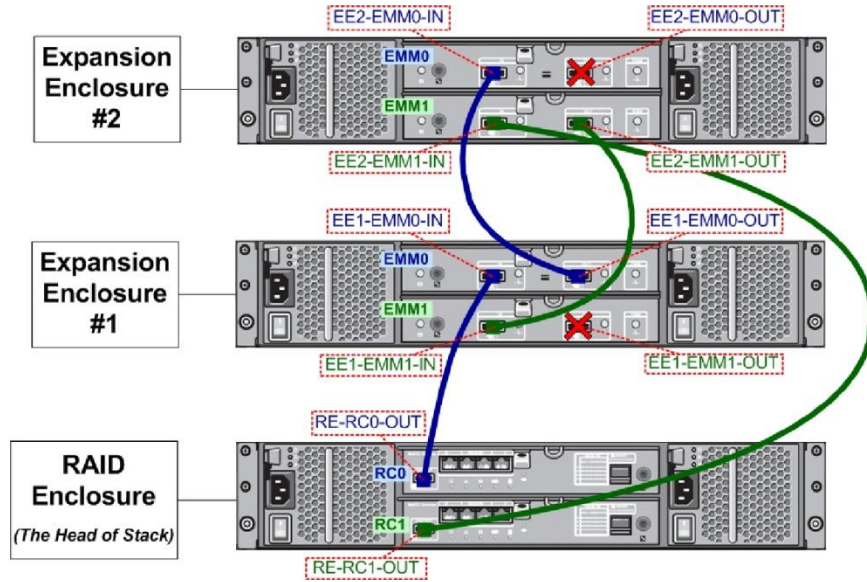
Figure 15.   SAS Cable Labels

Labels for SAS Cables

(Cut out the labels and attach them to the ends of the SAS cables

RE-RC0-OUT	RE-RC1-OUT		
EE1-EMM0-IN	EE1-EMM0-OUT	EE1-EMM1-IN	EE1-EMM1-OUT
EE1-EMM0-IN	EE1-EMM0-OUT	EE1-EMM1-IN	EE1-EMM1-OUT
EE2-EMM0-IN	EE2-EMM0-OUT	EE2-EMM1-IN	EE2-EMM1-OUT
EE2-EMM0-IN	EE2-EMM0-OUT	EE2-EMM1-IN	EE2-EMM1-OUT
EE3-EMM0-IN	EE3-EMM0-OUT	EE3-EMM1-IN	EE3-EMM1-OUT
EE3-EMM0-IN	EE3-EMM0-OUT	EE3-EMM1-IN	EE3-EMM1-OUT
EE4-EMM0-IN	EE4-EMM0-OUT	EE4-EMM1-IN	EE5-EMM1-OUT
EE4-EMM0-IN	EE4-EMM0-OUT	EE4-EMM1-IN	EE5-EMM1-OUT
EE5-EMM0-IN	EE5-EMM0-OUT	EE5-EMM1-IN	EE5-EMM1-OUT
EE5-EMM0-IN	EE5-EMM0-OUT	EE5-EMM1-IN	EE5-EMM1-OUT
EE6-EMM0-IN	EE6-EMM0-OUT	EE6-EMM1-IN	EE6-EMM1-OUT
EE6-EMM0-IN	EE6-EMM0-OUT	EE6-EMM1-IN	EE6-EMM1-OUT
EE7-EMM0-IN	EE7-EMM0-OUT	EE7-EMM1-IN	EE7-EMM1-OUT
EE7-EMM0-IN	EE7-EMM0-OUT	EE7-EMM1-IN	EE7-EMM1-OUT